



OVERCOMING THE CHALLENGES AND ADOPTION FOR NEW USERS IN ELECTRONIC IMMUNIZATION REGISTRY IMPLEMENTATION

—A CASE STUDY FROM VIETNAM—



USER-CENTERED APPROACH TO SYSTEM DESIGN, DEVELOPMENT, AND NOW IMPROVEMENT IS THE KEY TO SUCCESSFUL EIR IMPLEMENTATION AND SUSTAINABILITY IN VIETNAM

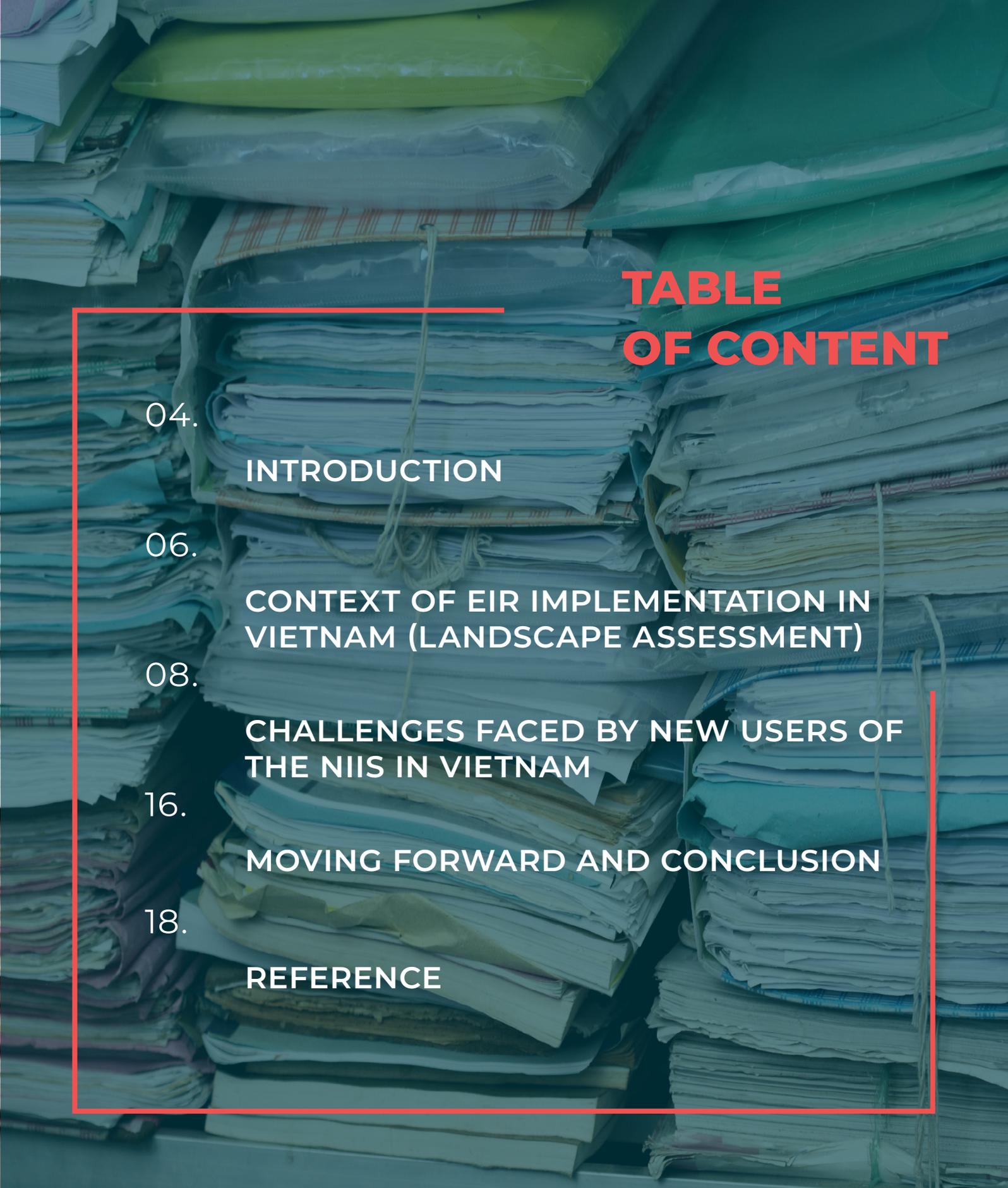


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ABBREVIATIONS

ABBREVIATIONS	CONTENT
CDC	Center for Disease Control and Prevention
CHC	Commune health center
EIR	Electronic Immunization Registry
FIF	Fee-based immunization facility
IDEAL Vietnam	Introducing Digital immunization information systems - Exchange and Learning from Vietnam
MOH	Ministry of Health
NEPI	National Expanded Program on Immunization
NIIS	National Immunization Information System



This case study was developed by the IDEAL-Vietnam project (Introducing Digital immunization information systems-Exchange And Learning from Vietnam), a collaboration of PATH, the Vietnam Ministry of Health, the Vietnam National Expanded Program on Immunization, and Viettel, and authored by team members from PATH and the National Expanded Program on Immunization.

We hope this report will contribute to ongoing discussions about immunization logistics, and we welcome comments from interested parties.

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1. INTRODUCTION

Electronic Immunization Registries (EIRs) are expected to provide a wide range of advantages to immunization staffs and their clients, thus improving immunization coverage of the population in general.¹ However, EIR systems are challenging to adopt in practice, as they require an alignment between the system functionality and the needs and working patterns of the target end users.² This entails a socio-technical approach and system design that is adapted specifically to its target end users.

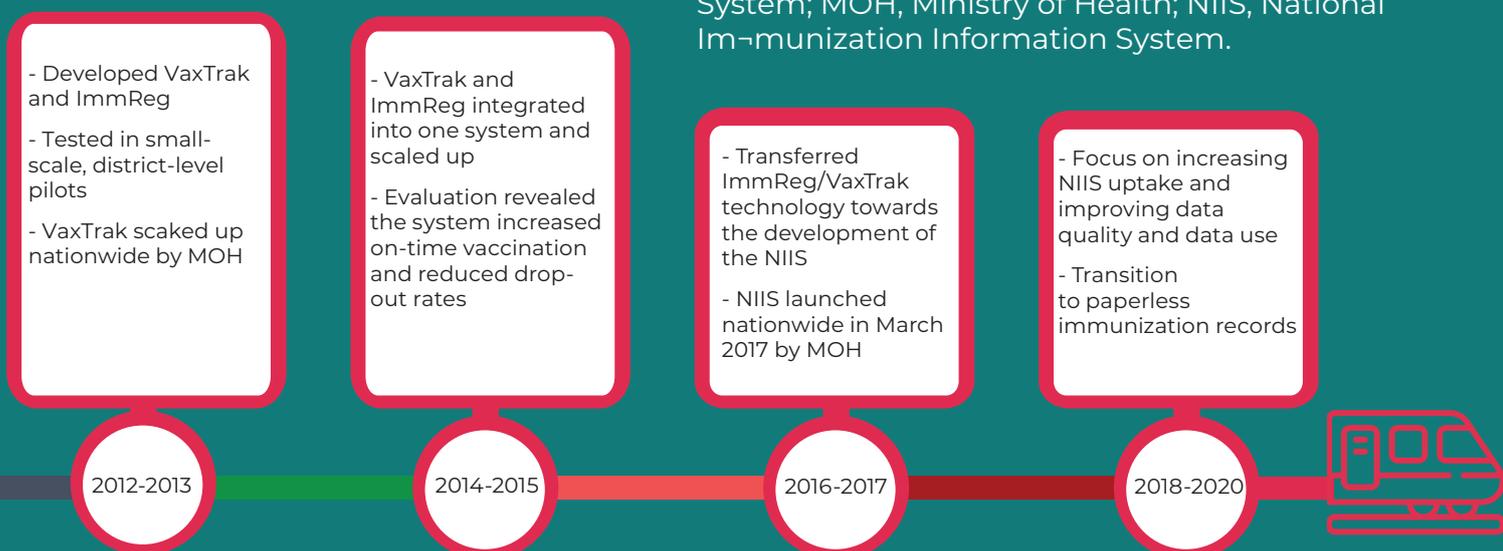
In this case, immunization staffs have a central role with EIRs as they are the ones who input data into the system that the systems need to function, as well as utilize the data in the system to perform their daily work. Thus, whether or not these frontline users support and use EIRs would have great impact on whether or not the

system is successfully implemented and scaled up nationwide.

With the launch of the National Immunization Information System (NIIS) in 2017, Vietnam has given much effort to fully integrate the electronic system and gradually transition to the complete elimination of the legacy paper system. Similar to any adoption process for successful implementation and transition, barriers and challenges by immunization staffs were carefully evaluated and prioritized to sufficiently address them. This user-centered approach started as early as the design phase and was carried throughout development and deployment phase (as described in [the case study](#) on Vietnam EIR design, development, and deployment³).

FIGURE 1. TIMELINE OF EIR EVOLUTION IN VIETNAM.

Abbreviations: ImmReg, Digital Immunization Registry System; VaxTrak, Vaccine Management System; MOH, Ministry of Health; NIIS, National Immunization Information System.



This case study, under the IDEAL Vietnam project granted to PATH by the Bill & Melinda Gates Foundation, is aimed at identifying and discussing the barriers faced by immunization staffs in Vietnam throughout the implementation process of the NIIS. It also shares the successful approaches to overcoming these barriers as well as some existing challenges that are yet to be solved. From these lessons learned in Vietnam, other countries with similar socio-technical environments may develop and adapt their own user-centered EIR implementation.



In Vietnam, immunization staffs are health care workers who are in-charge of immunization program. Typically, at the commune level, there is one immunization staff in each commune health center (CHC), who would be responsible for both clinical/vaccine administration, as well as administrative work to keep track of the immunization ledger, vaccine ledger, immunization coverage report, and vaccine report. At district or province level, immunization staffs' tasks involve more administrative work of management vaccine and immunization in their in-charge areas.



Interviews were conducted with representatives for immunization programs at all levels (communal, district, and provincial) as well as immunization staff in the private sectors in the two IDEAL Vietnam project provinces (Son La and Hanoi). Data, information, and perspectives were also consolidated from previous EIR project assessments in Vietnam (OPTIMIZE landscape assessments, IDEAL readiness assessments). Additionally, some valuable remarks were collected from PATH and National Expanded Program on Immunization (NEPI) staff who have been working on the system since its beginning stage.



2. CONTEXT OF EIR IMPLEMENTATION IN VIETNAM (LANDSCAPE ASSESSMENT)

An assessment of the immunization information system in Vietnam was completed in November 2009 under the OPTIMIZE project prior to any form of digital system in the immunization program. The assessment showed the following results: ⁴



TECHNICAL INFRASTRUCTURE

At province and district level, computers are available, though at district level they are sometimes shared with other health programs. Computers are often used for preparing monthly reports, which are sometimes emailed but also always submitted in hard copy form. At the commune level, computers are rare. In this survey one center had an internet-connected PC, two others had unconnected PCs, and the other nine had no computer.

Cell phone networks are available at all province, district, and CHCs, and personal cell phones are used by staff for voice communication with their respective superior and subordinate centers. There is currently no formal information exchange conducted by voice or SMS phone exchange.

Electricity infrastructure is relatively good at the province and district levels. All centers reported either reliable (89%) or intermittent (11%) availability of electricity. At the commune level, about half of the centers surveyed reported intermittent electricity availability—generally those in more remote areas.

HUMAN RESOURCES

There is a high level of turnover in human resources within the NEPI system, and leaders at the regional and national levels recognize that increased training and supervision for health care workers should be a high priority.

The staff at district, provincial, and national levels already have some exposure to computer systems, and software programs have been

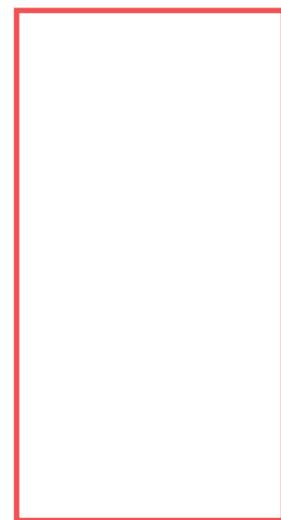
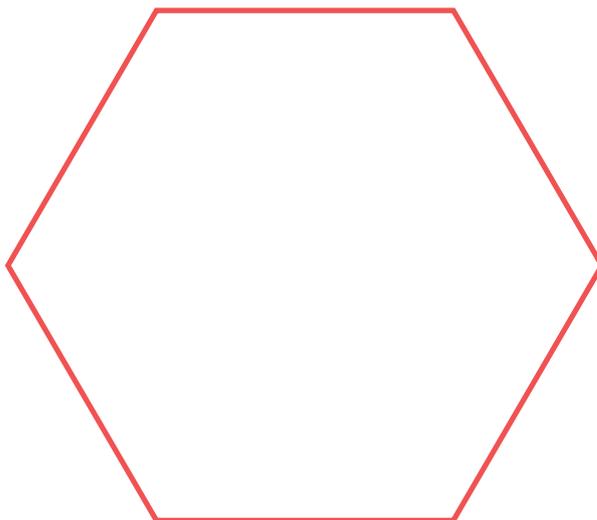
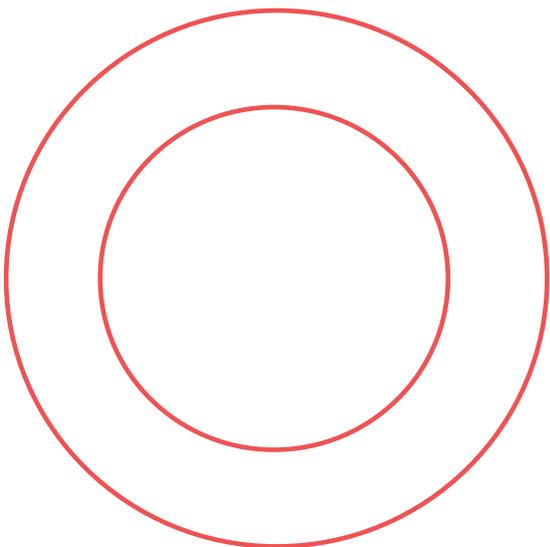
introduced at least to the province level in the past. There is a high level of interest by leaders at regional and national levels in exploring the application of information technology for managing the processes, supplies, and equipment used in the immunization program. The country is well served by mobile phone networks, and staff are familiar with and use their own cell phones regularly.

IMMUNIZATION SYSTEM

The immunization system achieved quasi-perfect coverage (93% full immunization coverage according to survey results) with a monthly session-based system. Its effectiveness in Vietnam can therefore not be doubted. Furthermore, it does this without investing in cold chain capacity at the lowest level and with extremely low average stock levels, making it very efficient from that point of view.

However, it is a very information- and labor-intensive system, and it relies on a communal political structure that is shared by some countries but not all. It relies on dedication of staff

to use it well, and as the study sites were selected by government, we can assume that we were exposed to good examples. Errors are easy to introduce in the paper-based system, where the same information is spread across several ledgers and reports. Errors that are introduced at lower level are carried through the system all the way to the final reports, from regional to NEPI. Furthermore, there is considerable confusion and mistrust of the accuracy of some of the data, in particular the calculation of the immunization coverage target number based on the inconsistent and unclear denominator estimation.

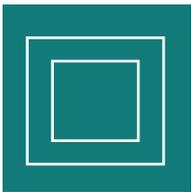


3. CHALLENGES FACED BY NEW USERS OF THE NIIS IN VIETNAM

Given the differences in infrastructure, in human resource capacity among different areas of the country, and between facility levels (CHCs, fee-based immunization facilities (FIFs), birth delivery clinics) and management levels (district, provincial, regional, and national), the challenges faced by new users varied.

As the NIIS was developed in an effort to standardize immunization services and data nationwide, implementators needed to standardize the infrastructure, the technology capacity of its human resources, and the appropriate procedures to meet all the basic requirements for the system.

AT FACILITY LEVEL



INSUFFICIENT INFRASTRUCTURE (ELECTRICITY, INTERNET, COMPUTER, PRINTER, BARCODE SCANNER)

Infrastructural capacity has been the limiting and deciding factor of the design and development of the EIR in Vietnam. Findings from the 2009 assessment show that when cell phone networks were widely available but internet access was limited and computers were rare, the EIR was developed on the mobile platform, which would work well on the existing GPRS cell phone bandwidth.

In 2014, a 3G mobile network was available and accessible for most of the population, and computers and cable internet connections were available at most CHCs in the piloted province of Ben Tre. The ImmReg was then switched to a web-based application for computers. Some CHCs without computers accessed the ImmReg via web browser on multi-touch smartphones, which were provided by the project. In 2017, as internet accessibility improved all over Vietnam, computers were also available in all CHCs across the country and the NIIS was upgraded and launched nationwide based on the foundation of the previous versions and developed to fit with the computer-based web browser. The EIR has evolved together with the development of Vietnam's information technology infrastructure.

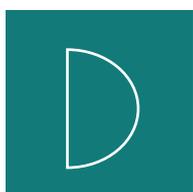
“We ask for used computers from different offices to supply for our CHC, or take advantage of other projects that funded us with computer, such as population program, or health insurance.”

—CHC immunization staff

With the full support from high-level government and the Ministry of Health (MOH), mobilizing funds for EIR infrastructure, though minimal, still justifiable. Many CHCs, especially the ones in remote areas, reported having only one computer, often an older model, in use for many different public health programs, not just immunization; thus, staff had to share computer time and programs had to share computer capacity. They often had to work over their lunch break to input

data into the system, giving priority to other medical and examination software during office hours. However, health workers at CHCs often take advantage of their multi-project funding or their network with other departments in the commune to supply their own computers.

Overall, the basic requirements for the NIIS at all facilities of NEPI were met.



LACK OF COMPUTER AND SYSTEM SKILL

This immunization staff was quite a typical case for immunization staffs in the remote mountainous CHCs, who were still working with virtually no or very limited exposure to computers. This lack of computer skill also led to staff's lack of confidence and resistance toward using the NIIS. It was not about merely changing to the new procedures and new ways of doing things. To these immunization staffs, the NIIS was a whole new field of technology, equipment, and system, and even a new way of life that they had to learn to adapt to.

This challenge was well recognized during the assessment, and it was addressed in the implementation design of the NIIS, including:

- o Developing a system with a user-friendly interface that was simple and easy to learn and use.
- o Developing standards of procedure for immunization on NIIS functionalities.
- o Planning for ample trainings of trainers and cascade trainings to follow, with a requirement of at least two health workers from each CHC (coupling one young and computer-savvy health worker with an older one with more immunization experience to complement each other).
- o Developing thorough guideline materials.
- o Providing 24/7 technical support from district and province level as well as PATH, and hotline from Viettel—the technical partner-developed NIIS—utilizing online tools to support virtually.

“Being introduced to NIIS was also the first time I was introduced to the computer. I didn't even know how to turn it on and off, or where the power button was at.”

—An experienced immunization staff in Son La province, who shared during an interview on the NIIS and the challenges she faced during the initial phase of implementation.

However, the most important approach to overcome this challenge came from immunization staffs themselves. After launching the NIIS and during training sessions, we quickly identified among learners the “NIIS champions” who showed their curiosity on the system, enthusiasm to

learn, and willingness to explore. Together with the system mandate from MOH and the support of higher-level and technical staff, these NIIS champions were the influencing factors that helped promote the acceptance among immunization staffs.

“From the initial days of system implementation, including the pilot phase, staff had to literally eat and sleep with the computer, fumbling with the simplest steps of turning on and off the computer, functioning with English platform and keyboard, moving the mouse. They mostly self-learned, asked colleague with more computer competency. Weekends, they would bring their children (high school or college students) to work (if they don’t have computer at home) to have them train the basic computer skill. Or they would have their children to train them at home.”

—PATH program officer from ImmReg and then IDEAL project

With all their effort and patience, they overcame their initial resistance and were open to change, and they learned that the computer was neither rocket science nor a hurdle to climb over, but rather a helpful tool to utilize.

“I never thought it would ever be possible to eliminate papers. And now that I’m familiar with the computer and using the system quite well, I don’t think I could ever go back to the papers!”

—CHC immunization staff



Remaining challenges

High staff turnover rate remains a challenge in EIR implementation, as an immunization staff gets acquainted with the system but is then rotated to a different position, and then a new staff has to learn the system from the start and slowly build up confidence with it.

The many tasks and projects that CHC staff have to take on often leave them with little time for training, learning, and exploring the new system.



WORK OVERBURDEN DURING THE INITIAL AND TRANSITION PHASES OF DUAL SYSTEMS

Immunization staffs at CHCs are the most labor-intensive positions within the centers. Immunization activities at CHCs also often require support from other staff, especially preparation for, during, and after scheduled immunization days. That does not include the shortage of staff who are on frequent rotation due to the high turnover rate. It takes quite some time for the immunization staffs to become fluent with their daily and monthly tasks. Therefore, any change in the immunization workflow, new process, or extra work imposes a significant burden on health workers.

The introduction of the NIS created extra workload, including::

- o Required trainings on the system and the new four-step immunization procedure (welcoming, screening, injection, and post-injection follow-up) for utilizing the system; extra learning efforts from the staff.
- o Required back data entry (two years of data) of all children born since January 1, 2015, to create the foundation database for the system to function.
- o Double work on dual systems—paper and electronic—during the transition phase to cross-check and ensure data quality.

“This [back data entry] was an enormous task. The staffs during the day already had to perform their regular daily activities, they had to tap on their leisure time as well as bringing all the documents home to input data till late into the night in order to complete their back data entry task. Furthermore, with their low computer skill, sometimes they typed in the wrong information or pressed on the wrong button, they had to call for support from their colleague or upper levels even during the night.”

—PATH program officer from ImmReg and then IDEAL project

These unavoidable burdens had to be recognized by the supervisors and upper levels. They supported immunization staffs by allocating other staff in CHCs to attend training for backup, assigning other staff to help with initial data input, and alleviating other tasks/projects that immunization staffs were involved in so that they could focus on the immunization program.

“There were two or three of us who just input data all day long. I also had to bring data home to input on the system. It was not easy but I am glad it was over.”

—CHC immunization staff



Remaining challenges

Immunization day is very labor intensive on both the clinical side and the administrative side. CHCs usually have to mobilize the entire staff to operate all the different steps of immunization activities. The immunization staff is typically the only staff who can use the system well, and thus, the four-step immunization procedure will have to be performed afterward.



FREQUENT SYSTEM UPDATES

The NIIS was not perfect (and still is not). Throughout the implementation process, multiple versions of the system have been developed, each version better than the previous one, addressing different reported bugs and errors. However, these changes created confusion and skepticism among new users. They have to keep cross-checking back with the paper system. Low-tech users might just disregard the system altogether and only use the paper tools.

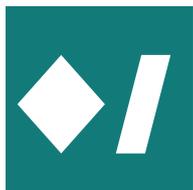
Provincial Center for Disease Control (CDC) in Son La and Hanoi have conducted refresher trainings for immunization staffs to update users with the new revised items in the system. Provincial CDC and district health center staff, PATH officers, and also Viettel hotlines are available for any error reports from users. Zalo (Vietnamese communication app) groups were created for easy communication flow. Recently, with the emergence of the COVID-19 pandemic, NEPI and PATH have trained and conducted virtual supportive supervision to CHC staff. As the staff becomes familiar with virtual supportive supervision, it provided a convenient and low-cost channel and opportunity for end users, managers, and developers to have direct conversation to solve the technical issues virtually.



Remaining challenges

Immunization regulation and policy are changed periodically as new vaccines are developed and added into the market; thus, the NIIS also needs to evolve accordingly. System updates are unavoidable. However, users still don't get all the updates in a timely manner despite all the effort from NEPI, CDCs, and district health centers. The COVID-19 pandemic also added to the challenge of conducting in-class/hands-on training.

Errors reported would take a long time to resolve, and necessary updates have to go through a lengthy process to get approved and to function well on the system.



INTEROPERABILITY

Although the majority of children vaccinated in Vietnam takes place at CHCs and within the NEPI system, they are not the only systems. A growing private sector of FIFs have complicated the immunization management for the population. FIFs are typical ahead in technology compared with NEPI facilities, and many of them have developed their own EIR to manage their clients. Thus, once the NIIS was introduced nationwide, the mandatory integration with the NIIS posed some reluctance from FIFs.

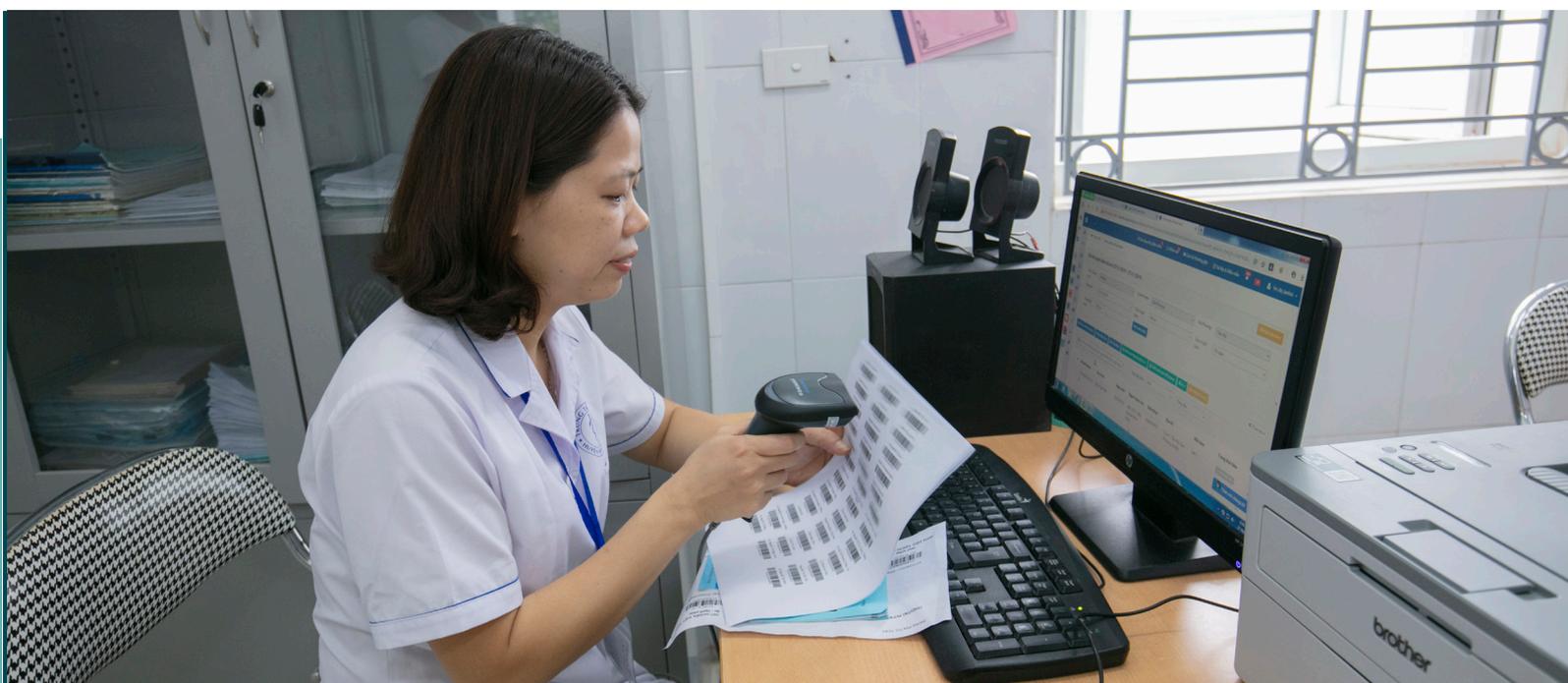
FIFs now have to either develop an application programming interface to exchange data between the two systems or assign designated personnel to enter immunization data into both systems.



Remaining challenges

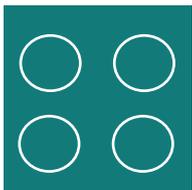
API development incurs additional cost for FIFs. Data transfer from their internal system to the NIIS also sparks confidentiality concerns regarding the personal and especially financial information of their clients.

On the other hand, double data entry manually to both the NIIS and their own system can lead to incomplete and inaccurate data due to human errors.





AT MANAGEMENT LEVELS OF DISTRICT HEALTH CENTERS, CDCs, AND NEPI



RESOURCE MANAGEMENT

With the low workforce capacity and poor infrastructure at facility levels, upper levels in NEPI had to continue providing technical and even emotional support to the lower-level staff. Computers and different equipment (printers, barcode scanning, etc.) are mobilized from one place to another to ensure the basic minimal requirement for the system to function. Besides training, they often had to encourage staff to take on the NIIS; they also made themselves available all the time for questions and concerns on the system on different channels—phone calls, Zalo group chat, etc.—and are the liason between users and the technical partners. Responses from most of the interviews with CHC staff stated that they received significant support and encouragement from their upper-level managers.

“Technical support was a huge effort from the upper-level staff. During the initial phase, most of them spent significant time in the CHCs to provide hands-on training and support from the basic computer skill. Furthermore, transportation from one commune to the next, especially in the remote and mountainous areas, was not easy, and could even be dangerous with rain, and storms. They often had to leave early in the morning and got back late, and would be on call as needed.”

—PATH program officer from ImmReg and then IDEAL project



DATA MANAGEMENT

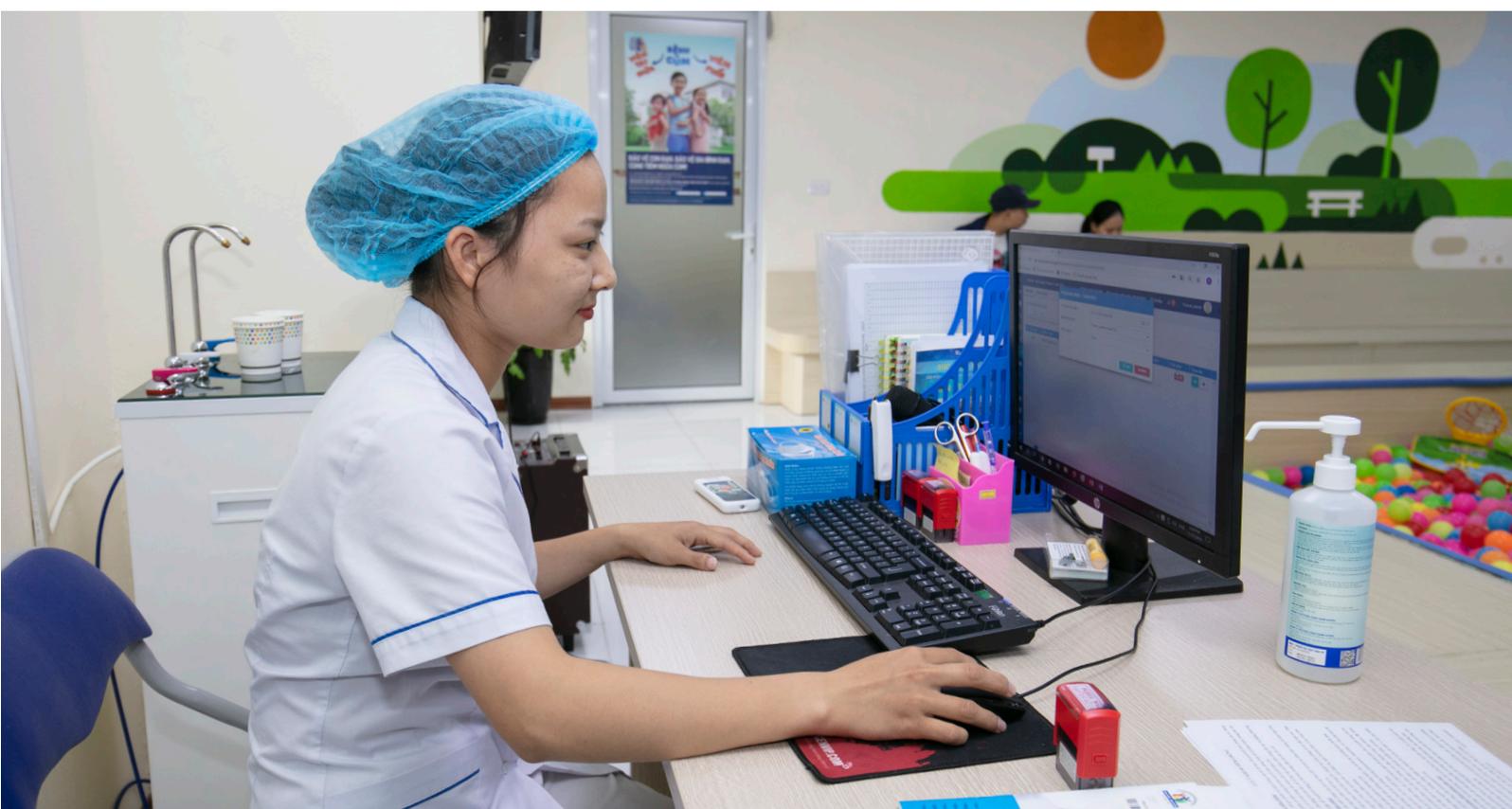
As the system is new to its users, and as the users are new to the computer, data entry and thus generated report quality can be tricky to evaluate. Management levels have to be able to recognize common issues in reports and quickly identify the cause of these issues to fix them. Virtually, it adds extra checking, investigation, and verification to their data management work.

Fortunately, staff at the management level understand clearly the benefits that the NIIS would bring to the immunization program and their work in the future.

“EIR is inevitable in this age of information technology. It is the obvious next step in data management. I can clearly [en]vision the benefit of NIIS and fully support the system.”

—Provincial immunization manager

Thus, they are willing to go the extra mile to strengthen the system usage in the immunization program.



4. MOVING FORWARD AND CONCLUSION

Tight collaboration among stakeholders with the user-centered approach to system design, development, and now improvement is the key to successful EIR implementation and sustainability in Vietnam. The Vietnam case also showed that the majority of the new user challenges lie within the facility level—where users have the most interaction with the system but the least understanding of the system and the skill to use it. Therefore, strategies to overcome these challenges should focus on addressing these grassroots users' issues, especially to motivate, encourage, and support them as they are the pivotal factor to the success of EIR implementation.

Moving forward, PATH and NEPI are getting the following interventions in the pipeline to address the remaining challenges:



HUMAN RESOURCE CAPACITY-BUILDING

Introduce an eLearning platform. The system continues changing with the new functions to ensure all end user requirements are met. This requires end user training and supportive supervision to update these functions and the changes. However, with human resources being limited, eLearning is one of the best solutions in this case. PATH and NEPI are developing an eLearning platform to provide users with the flexible opportunity to improve their skills with the system. This platform, once functioning stably and efficiently, can also be utilized to provide health care workers with frequent trainings and updates on any new systems, procedures, regulations, or guidelines. This would be the foundation for future capacity-building in our health care workforce.

Introduce the system to all facility staff. To organize for immunization sessions, a health facility needs to include most of the staff from the facility. If facilities have enough computers at all tables on the immunization session—registration, screening clients, giving immunizations, and following up after injection—that means all staff need to understand and know how to use the system. On the other hand, with high staff turnover, it is important to have more staff who work outside of immunization available to support the immunization staffs at the facility to use the system. Moreover, leaders should know about the system so they can manage, support, and encourage adoption.



SYSTEM AND DATA STREAMLINING

Develop clear standards of procedure on API guideline for FIFs to exchange data between their own systems and the NIIS. Involve Viettel once the two systems can be synced smoothly. The FIFs' engagement in the NIIS will increase, thus increasing the completeness of the database.

Develop a systematic information flow for bug/error reports, tracking, and system updates directly between Viettel and NEPI, so once PATH involvement is complete, the information flow does not get interrupted. Document different

iterations of each intervention. Create a log file that records all user feedback and the changes during their use of the system. It is important to have a mechanism for user feedback and resolution for each version of the intervention design to understand why the changes were made, as well as the decisions and context that led to those changes.



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